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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/752,798	12/28/2000	Mohamed Arafa	42390P8119	9364

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EXAMINER
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MAI, ANH D

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 02/12/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/752,798

Applicant(s)

ARAFAT ET AL

Examiner

Anh D. Mai

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 22 November 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-5 and 7-19 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5 and 7-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

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## DETAILED ACTION

### *Amendment*

1. Amendment filed November 22, 2002 has been entered as Paper No. 15. Claims 10-23 have been cancelled. Claims 1 and 11 have been amended. Claims 1-5 and 7-19 are pending.

### *Specification*

2. The amended title of the invention is still not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Since the use of BTBAS is important to the invention, the following title is suggested:

**METHOD OF MAKING SIDEWALL SPACERS USING bis-(tertiary butyl amino)  
silane (BTBAS).**

### *Claim Rejections - 35 USC § 103*

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 1-5, 7-14, 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chern '223 (cited previously) in view of Laxman '991 (cited previously).

Chern teaches a method of forming sidewall spacers adjacent opposing vertical sides of a gate electrode substantially as claimed including:

forming at least one gate electrode (14) over a substrate (10);

forming a first silicon oxide film (20) conformally over the substrate (10) and gate electrode (14) from a combination of gases and oxygen at a temperature;

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forming a silicon nitride film (22) conformally over the first silicon oxide film (20) from a combination of gases, at a temperature; and

forming a second silicon oxide film (24) over the silicon nitride film (22) from a combination of gases and oxygen. (See Fig. 4).

Thus, Chern is shown to teach all the features of the claim with the exception of using a specific precursor silane, temperature and pressure for the formation of the oxide and nitride layers. Note that, the claimed pressure does not appear to be critical.

However, Laxman teaches using an alternative silane precursor such as bis-(tertiarybutylamino)silane (BTBAS) to form silicon oxide at 550-625 °C and silicon nitride layer at 600 °C at an pressure of approximately 20 mTorr to 2 Torr.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the silicon oxide (20), silicon nitride (22) and silicon oxide (24) of Chern using a precursor silane including BTBAS at temperatures and pressure as taught by Laxman because BTBAS does not contain direct Si-C bonds thus, the deposited films have very low carbon content. (See col. 5, lines 29-31).

With respect to the claimed pressure, the disclosed pressure of Laxman includes “approximately 20 mTorr” this pressure is considered to be closed to the claimed value.

Also note that, the specification contains no disclosure of either the *critical nature of the claimed dimension of any unexpected results arising therefrom*. Where patentability is aid to based upon particular chosen dimension or upon another variable recited in a claim, the

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Applicant must show that the chosen dimension are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

With respect to claim 2, forming the silicon oxide film of Chern in view of Laxman comprises providing one or more wafers in a furnace at first temperature, and flowing BTBAS and oxygen into the furnace.

With respect to claim 3, forming the silicon nitride and the silicon oxide films of Chern in view of Laxman comprises keeping the one ore more wafers in the furnace.

With respect to claim 4, forming the silicon nitride film of Chern in view of Laxman comprises maintaining the one or more wafers in the furnace at a second temperature, and flowing BTBAS and  $\text{NH}_3$  into the furnace.

With respect to claim 5, forming the second silicon oxide film of Chern in view of Laxman comprises maintaining the one or more wafers in the furnace at the first temperature, and flowing BTBAS and oxygen into the furnace.

With respect to claims 7 and 9, Official Notice is taken, that purging the furnace prior to form another different film appears to be within the ability of one having ordinary skill in the art to prevent cross-contamination.

With respect to claims 8 and 10, Official Notice is taken, that how purging preformed is within the ability of one having ordinary skill in the art including shutdown all reactant gases follow by introducing inert gas then introducing the new reactant gas.

With respect to claim 11, the process of Chern, as shown in claim 1, further includes:

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forming at least one gate electrode (14/16/18) over a gate dielectric layer (12), the gate dielectric layer disposed on a substrate (10); and

forming a first sidewalls spacer. (See Figs. 2-5).

With respect to the precursor silane, temperature and pressure, a similar reason as that of claim 1 is also applied here.

With respect to claims 12 and 13, all films of Chern in view of Laxman are deposited in-situ in a first furnace.

With respect to claim 14, the furnace of Chern in view of Laxman comprises a vertically oriented furnace and the flow of the reactant gases into the furnace from the bottom are well known.

With respect to claim 16, forming of the first sidewall spacer of Chern in view of Laxman comprises anisotropically etching the second silicon oxide film (24), the silicon nitride film (22) and the first silicon oxide film (20).

With respect to claim 17, the process of Chern in view of Laxman further includes removing the second oxide film (24) to form L-shaped spacers. (See Fig. 6).

4. Claims 15, 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chern '223 and Laxman '991 as applied to claims 11 and 17 above, and further in view of Miles (U.S. Patent No. 6,233,597) (cited previously).

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With respect to claims 15 and 18, Chern and Laxman teach all the features of the claim with the exception of explicitly disclosing doping of the substrate to form source/drain region.

However, Miles teaches ion implantation is used to form a deep source/drain region in the substrate adjacent at least two opposing sides of the gate electrode. (See Fig. 3).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form source/drain regions adjacent to the gate of Chern as taught by Miles to reduce source/drain depth adjacent to the gate.

With respect to claim 19, the implanting dopant of Miles includes a partial passage of ions beam through a portion of the L-shaped spacers.

#### ***Response to Arguments***

5. Applicant's arguments with respect to all claims have been considered but are moot in view of the new ground(s) of rejection.

#### ***Conclusion***

6. Note that the addition of pressure have altered the scope of the previously claimed. Although all previously cited references are also applied in this Office Action, however, the scope of the claims have been changed.

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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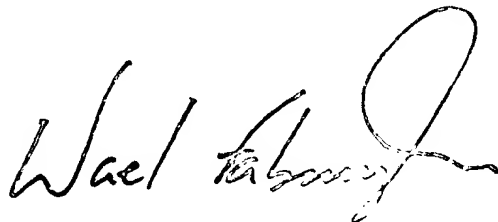
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M  
February 6, 2003

  
SUPERVISORY PRIMARY EXAMINER  
TECHNOLOGY CENTER 2000